App. No. 10/042,880   Docket No. 2001-0410
Art Unit: 2654

In the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the

application:

Listing of Claims:

1.   (Currently Amended). A method for enhancing speech intelligibility of a speech signal,

comprising ~~the steps of~~:

(a)   performing syllable segmentation on a frame of the speech signal in order to

detect a syllable;

(b)   dynamically determining a scaling factor for a segment of speech in response to

~~step (a)~~ performing syllable segmentation on a frame of the speech signal in order to detect a

syllable, wherein the segment is contained in the frame;

(c)   applying the scaling factor to the segment in order to modify a time scaling to the

segment; and

(d)   blending the segment with an overlapping segment in order to essentially retain a

frequency attribute of the speech signal that is processed, wherein:

the syllable is a time-scale modification syllable (TSMS) comprising a consonant-vowel

transition and a steady-state vowel, and

dynamically determining a scaling factor for a segment of speech comprises:

setting the scaling factor to a first value, wherein time expansion occurs during

the consonant-vowel transition; and

setting the scaling factor to a second value, wherein time compression occurs

during the steady-state vowel.

2.   (Canceled)

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3.   (Currently Amended) The method of claim [[2]] 1, wherein step (b) comprises the steps of:

setting the scaling factor to a first value, wherein the time expansion occurs during an approximate first one third of the TSMS[[;]], and

setting the scaling factor to a second value, wherein the time compression occurs during an approximate next two thirds of the TSMS.

4.   (Canceled)

5.   (Currently Amended) The method of claim [[4]] 1, where step (b) dynamically determining a scale factor for a segment of speech further comprises:

setting the scaling factor to a third value, wherein time compression occurs during low energy regions of the speech signal.

6.   (Original) The method of claim 5, wherein a time duration of the speech signal is essentially equal to a time duration of the processed speech signal.

7.   (Currently Amended) The method of claim 1, further comprising the step of:

(e)   modifying frequency domain characteristics of the speech signal in order that a transformed speech signal is characterized by enhanced acoustic cues.

8.   (Currently Amended) The method of claim 7, wherein step (e) modifying frequency domain characteristics of the speech signal comprises:

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adaptive spectral enhancing the speech signal, wherein a distinctness of spectral peaks of

the speech signal is increased.

9.   (Currently Amended) The method of claim 8, wherein step (e) modifying frequency

domain characteristics of the speech signal further comprises:

emphasizing higher frequencies of the speech signal, wherein an upward spread of

masking of the speech signal is reduced.

10.   (Currently Amended) The method of claim 1, wherein step (d) blending the segment

with an overlapping segment utilizes an algorithmic technique selected from the group

consisting of an overlap-add (OLA) technique and a waveform similarity overlap-add (WSOLA)

technique.

11.   (Currently Amended) The method of claim 1, wherein step (d) blending the segment

with an overlapping segment comprises the steps of:

adding the overlapping segment with the segment if a correlation between the two

segments is greater than a threshold; and

essentially retaining the segment if the correlation between the two segments is less than

the threshold.

12.   (Currently Amended) The method of claim [[2]] 1, wherein step (a) performing syllable

segmentation on a frame of the speech signal comprises:

detecting a high energy region of the speech signal.

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13.   (Currently Amended) The method of claim [[2]] 1, wherein step (a) performing syllable

segmentation on a frame of the speech signal comprises:

    detecting abrupt changes in frequency-domain characteristics of the speech signal.

14.   (Currently Amended) The method of claim [[2]] 1, wherein step (a) performing syllable

segmentation on a frame of the speech signal comprises:

    utilizing cross-correlation measures.

15.   (Currently Amended) The method of claim [[2]] 1, further comprising the step of:

    amplifying a first portion of the TSMS in order to partially restore an associated energy

in response to step (c) applying the scaling factor to the segment.

16.   (Currently Amended) The method of claim 1, further comprising the steps of:

    (e)   determining a time delay associated with the segment; and

    (f)   adjusting the scaling factor of a subsequent segment if the time delay is greater

than a threshold in response to step (c) applying the scaling factor to the segment.

17.   (Original) The method of claim 1, wherein the frequency attribute is a short-term Fourier

Transform (STFT) of the speech signal.

18.   (Currently Amended) The method of claim 1, further comprising the step of:

    (e)   outputting a processed speech signal to a telecommunications network in response

to step (d) blending the segment with an overlapping segment.

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19.   (Currently Amended) The method of claim 1, further comprising ~~the steps of~~:

    ~~(e)~~—estimating a pitch component of the speech signal;

    ~~(f)~~—utilizing information about the pitch component ~~in step (d)~~ <u>when blending the</u>

<u>segment with an overlapping segment</u> in response to ~~step (e)~~ <u>estimating a pitch component of the</u>

<u>speech signal</u>; and

    ~~(g)~~—outputting a processed signal to a speech coder in response to ~~step (f)~~ <u>utilizing</u>

<u>information about the pitch component</u>.

20.   (Original) The method of claim 19, wherein the speech coder is selected from the group

consisting of a code excited linear predication (CELP) coder, a vector sum excitation prediction

(VSELP) coder, a waveform interpolation (WI) coder, a multiband excitation (MBE) coder, an

improved multiband excitation (IMBE) coder, a mixed excitation linear prediction (MELP)

coder, a linear prediction coding (LPC) coder, a pulse code modulation (PCM) coder, a

differential pulse code modulation (DPCM) coder, and an adaptive differential pulse code

modulation (ADPCM) coder.

21.   (Currently Amended) The method of claim 1, further comprising ~~the step of~~:

    ~~(e)~~—outputting a processed speech signal to a speech coder in response to ~~step (d)~~

<u>blending the segment with an overlapping segment</u>.

22.   (Currently Amended) A method for enhancing an intelligibility of a speech signal

comprising ~~the steps of~~:

    ~~(a)~~—adaptive spectral enhancing the speech signal, wherein a distinctness of spectral

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peaks of the speech signal is increased;

(b)——emphasizing higher frequencies of the speech signal, wherein an upward spread of

masking of the speech signal is reduced;

(c)——extracting a frame from the speech signal;

(d)——calculating an energy contour and a spectral feature transition rate (SFTR) contour

corresponding to the frame;

(e)——performing syllable segmentation utilizing the energy contour and the SFTR

contour in order to detect a time-scale modification syllable (TSMS);

(f)——applying a scaling factor to a segment of speech, wherein the segment

corresponds to a portion of the frame, comprising:

(i)——setting the scaling factor to a first value ~~if~~ when a consonant-vowel

transition is detected within the TSMS, time expansion occurring during the consonant-

vowel transition;

(ii)——setting the scaling factor to a second value ~~if~~ when a steady-state vowel is

detected with the TSMS, time compression occurring during the steady-state vowel; and

(iii)——setting the scaling value to a third value for other portions of the speech

signal;

(g)——determining an overlapping segment that is best-matched to the segment

according to a cross-correlation and waveform similarity criterion;

(h)——calculating a time delay associated with the segment;

(i)——adjusting the scaling factor associated with a subsequent segment according to the

calculated time delay ~~determined in step (h)~~;

(j)——overlapping and adding the segment and the overlapping segment; and

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~~(k)~~—outputting a modified frame in response to processing all constituent segments of

the frame.

23.   (Currently Amended) A method for enhancing an intelligibility of a speech signal

comprising ~~the steps of~~:

(a)—extracting a frame from the speech signal;

(b)—calculating an energy contour and a spectral feature transition rate (SFTR) contour

corresponding to the frame;

(c)—performing syllable segmentation utilizing the energy contour and the SFTR

contour in order to detect a time-scale modification syllable (TSMS);

(d)—applying a scaling factor to a segment of speech, wherein the segment corresponds

to a portion of the frame, comprising:

(i)-setting the scaling factor to a first value ~~if~~ when a consonant-vowel transition

is detected within the TSMS, time expansion occurring during the consonant-vowel

transition;

(ii) setting the scaling factor to a second value ~~if~~ when a steady-state vowel is

detected with the TSMS, time compression occurring during the steady-state vowel; and

(iii) setting the scaling value to a third value for other portions of the speech

signal;

(e)—determining an overlapping segment that is best-matched to the segment

according to a cross-correlation and waveform similarity criterion;

(f)—calculating a time delay associated with the segment;

(g)—adjusting the scaling factor associated with a subsequent segment according to the

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<u>calculated</u> time delay ~~determined in step (h)~~;

(h)——overlapping and adding the segment and the overlapping segment; and

(i)——outputting a modified frame in response to processing all constituent segments of

the frame.

24.   (Currently Amended) A method for enhancing an intelligibility of a speech signal that is

processed by a speech coder, comprising ~~the steps of~~:

(a)——extracting a frame from the speech signal;

(b)——performing syllable segmentation in order to detect a time-scale modification

syllable (TSMS);

(c)——applying a scaling factor to a segment, wherein the frame comprises at least one

segment, comprising:

(i)——setting the scaling factor to a first value ~~if~~ <u>when</u> a consonant-vowel

transition within the TSMS is detected<u>, time expansion occurring during the consonant-</u>

<u>vowel transition</u>;

(ii)——setting the scaling factor to a second value ~~if~~ <u>when</u> a steady-state vowel

within the TSMS is detected<u>, time compression occurring during the steady-state vowel</u>;

and

(iii)——setting the scaling factor to a third value for other portions of the frame;

(d)——estimating ~~the~~ <u>a</u> pitch component of the frame;

(e)——determining an overlapping segment that is best-matched to the segment

according to a cross correlation and waveform similarity criterion, and to the speech component

if the frame has a voiced characteristic;

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(f)——combining the segment with an adjacent segment, comprising:

   (i)——overlapping and adding the segment and the overlapping segment if a

correlation between the segment and the overlapping segment is greater than a threshold;

and

   (ii)——essentially retaining the segment if the correlation between the segment

and the overlapping segment is less than the threshold; and

(g)——outputting a modified frame to the speech coder in response to processing all

constituent segments of the frame.

25.   (New) A method comprising:

performing syllable segmentation on a frame of the speech signal in order to detect a

syllable;

dynamically determining a scaling factor for a segment of speech in response to

performing syllable segmentation on a frame of the speech signal in order to detect a syllable,

wherein the segment is contained in the frame;

applying the scaling factor to the segment in order to modify a time scaling to the

segment; and

blending the segment with an overlapping segment in order to essentially retain a

frequency attribute of the speech signal that is processed, wherein:

performing syllable segmentation on a frame of the speech signal in order to detect a

syllable comprises detecting abrupt changes in frequency domain characteristics of the speech

signal.

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26.   (New) The method of claim 25, wherein dynamically determining a scaling factor for a

segment of speech comprises:

setting the scaling factor to a first value, wherein time expansion occurs during an

approximate first one third of the TSMS; and

setting the scaling factor to a second value, wherein time compression occurs during an

approximate next two thirds of the TSMS.

27.   (New) The method of claim 25, wherein dynamically determining a scaling factor for a

segment of speech comprises:

setting the scaling factor to a first value, wherein time expansion occurs during the

consonant-vowel transition; and

setting the scaling factor to a second value, wherein time compression occurs during the

steady-state vowel.

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